Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/43**

Paper 4 Extended Theory **October/November 2018**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

PUBLISHED

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

NOTES ABOUT MARK SCHEME SYMBOLS & OTHER MATTERS

B marks	are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.
M marks	are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent A marks can be scored.
C marks	are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it.** For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
A marks	A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored. A marks are commonly awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded.
Brackets ( )	Brackets around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.
<u>Underlining</u>	Underlining indicates that this <u>must</u> be seen in the answer offered, or something very similar.
OR / or	This indicates alternative answers, any one of which is satisfactory for scoring the marks.
e.e.o.o.	This means "each error or omission".
o.w.t.t.e.	This means "or words to that effect".
Ignore	This indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.
Spelling	Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, do not allow ambiguities, e.g. spelling which suggests confusion between reflection / refraction / diffraction or thermistor / transistor / transformer.
Not/NOT	This indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate, i.e. right plus wrong penalty applies.

ecf	meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate from being penalised more than once for a particular mistake, but **only** applies to marks annotated ecf.
Significant	Answers are normally acceptable to any number of significant figures ≥ 2. Any exceptions to this general rule will be specified in the mark scheme.
Units	Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: **maximum 1 per question**. No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working. Unless listed here or stated in the mark scheme for the question, do not accept derived units e.g. kg m / s^2 for N is NOT acceptable. The following are acceptable alternatives: N m for J, J / s or N m / s for W, N / m^2 for Pa, N s and kg m / s are both acceptable for momentum and impulse. Beware: J is NOT acceptable for moments. Condone wrong use of upper and lower case symbols e.g. pA for Pa. Annotate with U. For more than one unit error in a question, underline with a wavy line to indicate an error which has not been penalised.
Arithmetic errors	Deduct one mark if the **only** error in arriving at a final answer is clearly an arithmetic one. Regard a power-of-ten error as an arithmetic error.
Transcription errors	Deduct one mark if the only error in arriving at a final answer is because previously calculated data has clearly been misread but used correctly.
Fractions	Allow these only where specified in the mark scheme.
Crossed out work	Work which has been crossed out **and not replaced but can easily be read**, should be marked as if it had not been crossed out.
Use of **NR**	Use this if the answer space for a question is completely blank or contains no readable words, figures or symbols.

Question	Answer	Marks
1(a)	P marked on line between t = 0 s and t = 30 s	**B1**
1(b)(i)	(v =) gradient **or** 150 / 30 **or** appropriate division using other points	**C1**
	5.0 m / s	**A1**
1(b)(ii)	(v =) x / t **or** (300 – 150) / (45 – 30) **or** 150 / 15	**C1**
	10 m / s	**A1**
1(c)	gradient decreasing	**B1**
	smooth transition to horizontal **and** line not too thick	**B1**
	horizontal to (60 s, 400 m)	**B1**

Question	Answer	Marks
2(a)	1st box: force	**B1**
	2nd box: impulse	**B1**
2(b)(i)	**1** (p =) mv **or** 0.046 × 65	**C1**
	3.0 kg m / s **or** 3.0 N s	**A1**
	2 (F =) $m(v – u) / t$ **or** 3.0 / 0.00050 **or** a = $(v – u) / t$ **and** F = ma **or** 0.046 × 65 / 0.00050 **or** 0.046 × 130 000	**C1**
	6000 N **or** 6000 N	**A1**
2(b)(ii)	elastic (energy) **or** strain (energy)	**B1**

Question	Answer	Marks
3(a)(i)	(mercury) barometer	**B1**
3(a)(ii)	vacuum **or** nothing **or** (low pressure) mercury vapour	**B1**
3(a)(iii)	$(p) = h\rho g$ **or** $0.76 \times 1.4 \times 10^4 \times 10$	**C1**
	1.1×10^5 Pa	**A1**
3(b)	$(m =)\rho V$ **or** $\rho \pi r^2 l$ **or** $\rho \pi d^2 l / 4$ **or** in numbers	**C1**
	$(W =)\rho Vg$ **or** $\rho \pi r^2 lg$ **or** $\rho \pi d^2 lg / 4$ **or** in numbers	**C1**
	84 N	**A1**

Question	Answer	Marks
4(a)	$(f =) v / \lambda$ **or** 0.15 / 0.030	**C1**
	5.0 Hz	**A1**
4(b)(i)	transmission of energy (through medium) **and** no transfer of matter	**B1**
	(direction of) vibration of particles **or** (direction of) vibration of medium	**M1**
	perpendicular to direction of energy travel / wave / propagation	**A1**
4(b)(ii)	wave with constant wavelength and amplitude	**B1**
	wavelength indicated **and** labelled	**B1**
	amplitude indicated **and** labelled	**B1**

Question	Answer	Marks
5(a)	power supply **and** (top-pan) balance / scales **and** stopwatch / timer / joulemeter	**B1**
	measure mass (of block) **and** initial **and** final temperature	**B1**
	reading from joulemeter **or** measure time (of heating) **and** (E =) Pt / VIt **or** $c = Pt / m\Delta T$	**B1**
	$c = Pt / m\Delta T$ **or** $c = E / m\Delta T$	**B1**
5(b)(i)	energy required to increase the temperature per °C / per unit temperature increase	**B1**
5(b)(ii)	(C =) $m\,c$ **or** 85×460	**C1**
	3.9×10^4 J / °C	**A1**

Question	Answer	Marks
6(a)(i)	correct refractions **and** dispersion at first surface	**M1**
	correct **and** more refractions of both rays at second surface **and** (more) divergence **and** labels	**A1**
6(a)(ii)	violet	**B1**
6(b)(i)	(light of) a single frequency	**B1**
6(b)(ii)	total internal reflection (at side AC) **or** internal reflection **and** no refraction	**B1**
	angle of incidence greater than critical angle / 42° (and refractive index of glass greater than that of air than air)	**B1**
6(b)(iii)	light refracts (at Y)	**B1**
	angle of incidence less than critical angle / 42°	**B1**
	(some) light reflects	**B1**

Question	Answer	Marks
7(a)(i)	no delocalised / free / mobile electrons in an insulator **or** electrons fixed (in place) / tightly bound in an insulator	**B1**
7(a)(ii)	no charge flows / current in doctor **or** doctor does not receive an electric shock	**B1**
	which might prove fatal / kill / injure / harm doctor **or** so charge flows / current in patient	**B1**
7(b)	electrons move (from one contact to the other)	**B1**
	negative contact gains electrons / negative charges **and** positive contact loses electrons / negative charges	**B1**
7(c)	(I =) Q/t **or** $9.1 \times 10^{-3}/6.5 \times 10^{-4}$	**C1**
	14 A	**A1**

Question	Answer	Marks
8(a)	from chemical (energy) to thermal / heat (energy)	**C1**
	from chemical (energy) to thermal / heat (energy) **and** as a result of electrical working	**A1**
8(b)(i)	(I =) V / R **or** 2.4 / 120	**C1**
	0.020 A	**A1**
8(b)(ii)	6.6 V	**B1**
8(b)(iii)	330 Ω	**B1**
8(c)	multiplication by 5.0 **or** $R \propto l$	**C1**
	multiplication by 2.0 / 4.0 **or** division by 0.50 / 0.25 **or** $R \propto 1 / A$ **or** $R \propto 1 / r^2$	**C1**
	multiplication by 4.0 **or** division by 0.25 **or** 20 × 330	**C1**
	6600 Ω	**A1**

Question	Answer	Marks
9(a)	(a d.c. has) constant value / magnitude **or** direction does not change **or** has only one direction	**B1**
9(b)(i)	sinusoidal curve in phase with voltage **and** maximum value of 0.75 A **and** same frequency	**B1**
9(b)(ii)	(P =) VI **or** 7.2×0.75	**C1**
	5.4 W	**A1**
9(c)(i)	vertical, upward arrow labelled M on side AB	**B1**
9(c)(ii)	A to B **and** (Fleming's) right-hand rule (in some way)	**B1**
	rule explained (i.e. fingers explained or labelled 3D diagram)	**B1**
9(c)(iii)	greater (maximum) voltage	**B1**
	greater frequency **or** smaller time period **or** changes direction more often **or** alternates faster	**B1**

Question	Answer	Marks
10(a)	$^{234}_{91}(\text{Pa})$	**B1**
	$^{0}_{-1}(\beta)$	**B1**
10(b)	72 / 24 **or** 3.0 (half-lives)	**C1**
	2^3 **or** 1 / 8 **or** 2480 / 8	**C1**
	310 counts / second	**A1**
10(c)	count rate larger (than 310 counts / second)	**B1**
	protactinium is also emitting (β-)particles / (nuclear) radiation	**B1**
	count rate (approximately) double **or** product of protactinium decay also radioactive **or** amount of protactinium small **or** protactinium is highly radioactive **or** half-life of protactinium much shorter (than half-life of thorium) / very short	**B1**